DOCUMENT RESUME

ED 337 664 CE 059 333

AUTHOR Ovans, Gary L.
TITLE An Assessment of Criteria that Will Contribute to a Desirable Industrial Internship Model for the Manufacturing Engineering Technology Program at Ferris State University.
PUB DATE Aug 91
NOTE 68p.
PUB TYPE Reports - Research/Technical (143) -- Tests/Evaluation Instruments (160)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Apprenticeships; Educational Research; Employer Attitudes; Engineering; Engineering Education; *Engineering Technology; Higher Education; *Internship Programs; Literature Reviews; *Manufacturing; Manufacturing Industry; Models; Program Design; Program Improvement; School Business Relationship; State Surveys; Technical Education
IDENTIFIERS *Ferris State University MI

ABSTRACT

A study was conducted to determine if the structure and administration of the manufacturing internship of the Manufacturing Engineering Technology (MET) program at Ferris State University (FSU) was congruent with commonly accepted practice. It examined whether the current internship design was satisfactory in terms of the perspective of industry and provided insights into program changes that may improve the internship experience. A survey was mailed to 200 industrial manufacturing engineering professionals throughout the state of Michigan. Its 18 items encompassed respondents' demographic characteristics, format of the internship. and respondents' experience with internship programs. A comparison of the MET internship at FSU with the internships of other programs/schools indicated that its criteria fell into a matrix of commonly accepted practice as identified through a literature review. With regard to the relationship with industry, survey results supported what was current practice with the MET internship, with few exceptions. Results confirmed that: (1) industry participants found the current 10-week internship acceptable and would accept a program revision to include a 20-week dual internship; (2) the faculty internship coordinator played only a limited role in interns' onsite activities; (3) compensation should be negotiated between the intern and intern site; and (4) potential sites would be highly receptive to having interns available throughout the year. (Appendixes include 29 references, curriculum requirements, and the instrument.) (YLB)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED337664

An Assessment of Criteria That Will Contribute to a Desirable Industrial Internship Model for the Manufacturing Engineering Technology Program at Ferris State University

Gary L. Ovans

August 1991

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☒ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

G L Ovans

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

CE 059 333

BEST COPY AVAILABLE

Table of Contents

Page

Title Page i
Table of Contents ii
Abstract 1
Keywords 2

Chapter 1
Introduction 3
Background. 3
Statement of Problem 5
Purpose of Study 5
Questions to be answered 6
Definitions of terms 6
Scope and Delimitations of the Study 8
Assumptions 8

Chapter 2 9
Literature Review 9
Summary of Literature Review 14

Chapter 3 15
Research Design and Methodology 15
Section of Subjects 17
Field Procedures. 17
Data Collection and Analysis 18

Chapter 4 19
Research Findings 19

Chapter 5 47
Summary 48
Conclusions 50
Recommendations 51

References 53

Appendices 56
A. Program Check Sheet 58
B. Survey Letter 60
C. Questionnaires
Intern Site 62
D. School of Technology Questionnaire 65

Gary Ovans

Dr. Edward Cory

EDU 546

August 1990

An Assessment of Criteria that will Contribute to a Desirable Industrial Internship Model for the Manufacturing Engineering Technology Program at Ferris State University

ABSTRACT

The concept of providing engineering and engineering technology students with practical work experience as a vehicle for enhancing their classroom experience is embraced by schools across the country. The Manufacturing Engineering Technology program offers a similar experience. The purpose of this study was to determine if the internship experience, as defined by the manufacturing program adhered to common practice and, more importantly, is the market place (industry) in agreement with the faculty as to the design and administration of the internship. The results of the study indicate that there is considerable agreement between industry and the faculty concerning the current format of the internship.

KEYWORDS

Internship programs, technical education, post secondary education, higher education, apprenticeships, cooperative education, vocational education, work experience programs, alternative training.

CHAPTER 1

INTRODUCTION

In 1906, Herman Schneider, Dean of the College of Engineering at the University of Cincinnati, first proposed the concept of alternating formal schooling with a practical work experience (Cooperative Engineering Education, 1987). Since its inception, the concept has been adopted by educational institutions throughout the country.

Engineering and engineering technology programs have embraced the idea put forward by Dean Schneider, through the development of cooperative engineering education and industrial internships. According to L. A. Madonna, Dean of Widner College, Chester, Pennsylvania (1983), "The purpose of this program is to validate the student's classroom experience and reinforce it when appropriate; it is to mature the student with regard to his interaction with other human beings; it is to understand the meaning of profit to a corporation and success to himself." (p. 65).

BACKGROUND

The Manufacturing Engineering Technology program was put into effect the Fall quarter of 1976. The graduation of the first group of students took place in May of 1978. The program is offered at the baccalaureate level with the objective of preparing students for entry level positions in industry. A typical graduate might assume the position of process engineer,

quality engineer, production engineer, tooling engineer, or manufacturing engineer.

A major component of the program is the professional internship experience (Appendix A). The student fulfills this requirement (MFG 390 - Professional Internship) during the Summer Quarter between the junior and senior year of study.

From its inception the Manufacturing Engineering Technology program has undergone continuous modification through changes in individual course content. Change is essential if programs are to maintain a level of currency of content that is not outdated, and adequately prepare the graduating student. As the Manufacturing Engineering Technology program prepares students for roles in industry, those individuals that design the program content must be sensitive to the changing requirements of industry, and fabricate a program that meets those requirements. With that in mind, the Manufacturing Engineering Technology faculty began evaluating its program during the second half of the 1988-1989 school year. By the end of the 1989-1990 school year, a proposal was completed that incorporated major revisions into the program content.

As part of the evaluation effort, the manufacturing faculty considered several options that pertained to the professional internship requirement. To gain insight into what might constitute a viable industrial internship requirement, existing internship formats within programs in the School of Technology were examined, and the advice of the Manufacturing Engineering

Technology advisory board was solicited. After consideration of the limited amount of information available concerning industrial internships, it was felt that additional input in the form of survey information from potential industrial internship sites could provide guidance in establishing an optimum framework upon which to base the student internship requirement. The intent of the manufacturing faculty was to fashion a quality internship experience that would serve both the student and the industrial site, while meeting boundaries imposed by budgetary and credit-hour limit constraints.

STATEMENT OF PROBLEM

The format of the current Manufacturing Engineering Technology industrial internships is based upon past practice. In order to fashion an industrial internship model that is relevant and current, a study must be conducted to determine those attributes that constitute a proper internship format.

PURPOSE OF THE STUDY

The results of this study will assist the Manufacturing Engineering Technology faculty in determining the validity of current practices as they pertain to the professional internship. The study will also provide information that will assist the faculty in making program changes that will improve the internship experience for both the student and the industrial internship site. The information from this study can also

benefit other programs that utilize the professional industrial internship as a medium for providing the student with practical work experience.

QUESTIONS TO BE ANSWERED

The questions to be answered are:

1. What are the demographic characteristics of the respondents to the questionnaire?
2. Is there any correlation between the respondents' demographic characteristics and their responses to non-demographic questions on the questionnaire?
3. Is there any correlation existing between respondent experience with internships and their responses to non-demographic survey questions?
4. What constitutes the proper length of time for an industrial internship?
5. Should the internship experience be offered throughout the calendar year?
6. To what extent should faculty be involved with the intern/ internship site?
7. What constitutes proper work content for the student intern?
8. What should be the nature of compensation for a student intern?
9. Should student interns be compensated when required to locate at an internship site beyond commuting distance from home?

DEFINITION OF TERMS

The following terms are defined to clarify their use in the analysis of the stated research questions:

1. Cooperative education - a process of education which formally integrates the student's academic study with

work experience in cooperating employer organizations. (Adapted from Cooperative Education Association Constitution and By-Laws.)

2. Industrial Internship - industrial on-the-job experience phase of the educational curriculum.
3. Respondents - Those who have responded to the questionnaires and are considered in the results of the study.
4. Manufacturing Engineering Technology - The application of scientific and engineering knowledge and methods combined with technical skills to understand, apply and control technical procedures in manufacturing processes and methods of production of industrial products and commodities. (Adapted from Definitions of Manufacturing Engineer and Engineering Technology, Society of Manufacturing Engineers.)
5. Quarter term - An academic term of 10 weeks duration. The result of dividing an academic calendar year into four equal segments.
6. Semester term - An academic term that is typically 15 or 16 weeks in length. The result of dividing an academic calendar year into three equal segments.
7. MFG - Manufacturing Engineering Technology
8. F.S.U. - Ferris State University

SCOPE AND DELIMITATIONS OF THE STUDY

The following limitations were imposed in regard to the research. Questionnaires were mailed to former, current (Summer Quarter 1989), and potential industrial sites in the state of Michigan. While the results of the study may have ramifications for other technology programs that have internship experiences, the questionnaire was designed for the specific needs of the B. S. MFG program. The questionnaire dealt only with those aspects of the industrial internship that directly impacted the intern site.

ASSUMPTIONS

1. The respondents would answer the questionnaire accurately.
2. Participants not responding to the questionnaire are not included in the report of the findings.
3. The report of the findings of those respondents to the questionnaire do not necessarily correlate with those who did not respond.

CHAPTER 2

LITERATURE REVIEW

A search of the Eric computer data base was initiated to locate research relevant to this project. The keywords used in the search were: internship programs, technical education, post secondary education, higher education, apprenticeships, cooperative education, vocational education, work experience programs, alternative training. A shotgun approach was used producing unusable results. The search was then focused, using the keywords: internship programs, technical education, and post secondary education.

While the resulting few citations and abstracts provided information that was more closely correlated with the topic of the project, very little, if any, additional substantive insights were obtained.

The most useful source of information was the Cooperative Education Research Center at Northeastern University in Boston, Massachusetts. Twelve articles were reviewed that pertained to cooperative education and internship arrangements. According to an article by Ernest L. Minelli in Contemporary Concepts in Vocational Education, "Objectives of the industrial internship are: (a) To provide on-the-job experiences in industry, (b) to gain a functional understanding of industry, (c) to develop technical competencies, (d) to provide experiences in human relationships" (p. 295).

In an article in the Journal of Cooperative Education, Dena A. Weinstein, reviewing the works of researches in cooperative education, states, that the

> "Cooperative education work experience had a considerable impact upon student development during the college years, particularly in the area of career development." Weinstein also reports "That participation in cooperative education programs increased an undergraduate's perception of career readiness" (p. 34).

Pierce and Birmingham write that "Internships provide students with the best of both worlds; a rigorous education in the college setting and first-hand work experience in local industry" (p. 288).

They further state that the internship "Must be directly related to the field of study in which the student is engaged and to the student's career objectives, goals, and interests. During work periods, the student's full-time obligation is to the employer" (p. 289).

Winer, Howe and Berestecky in their study of cooperative work assignments, conclude that "Engineering students experiencing curriculum related cooperative work assignments were far more satisfied with their experiences than their classmates who were employed on unrelated cooperative work assignments" (p. 39).

Yensco found, in a study of college and industrial personnel with a history of involvement in cooperative engineering programs, that "College and industrial personnel support the major values of the cooperative system and indicated that co-op graduates are well motivated and are more mature at graduation .p166

than regular graduates." He also concludes that " co-op graduates are immediately employable in productive assignments at a higher beginning salary and with a one or two year experience lead over regular graduates" (p. 818).

Madonna suggests that an undergraduate curriculum embracing the concept of cooperative education embrace four elements:

(1) the unified curriculum

(2) the problem laboratories

(3) the internship or external practicum

(4) the senior project course or internal practicum (p. 63).

Cosgrove refers to problems associated with developing a cooperative system when he writes, "The logical sequence of basic math, basic science, core engineering courses, and design courses must be followed, despite interruptions for work sections. Courses designed to prepare the students for their first work assignments must be included in the first- year curriculum. The typical four-year engineering program is expanded to five years by the inclusion of six quarters of pre-professional work experience", and, "Students who encounter early academic difficulties are required to defer entry into the work-study alternations."

An additional source of useful information came from university bulletins received from universities located in and out of Michigan. Additionally, a survey was distributed

to school of Technology, Ferris State University, Bachelor of Science programs that require an internship experience to fulfill degree requirements. Reviews of curriculums listed in the bulletins, and the results of the School of Technology survey of programs that utilized internships, provided insights into the makeup of typical cooperative and internship arrangements. The results are summarized in Figure 1, Page 13.

Legend for Figure 1

A - Brigham Young University, Utah
B - University of Wisconsin - Stout, Wisconsin
C - Central Michigan University
D - University of Michigan Dearborn
E - Western Michigan University
F - Lawrence Institute of Technology
G - Grand Valley State University
H - Michigan State University
Ferris State University
School of Technology
I - B.S. Facilities Management
J - B.S. Energy Management
K - B.S. Automotive Service Management
L - B.S. Design Engineering Technology
M - B.S. Welding Engineering Technology
N - B.S. Plastics Engineering Technology
O - B.S. Electrical Engineering Technology
P - B.S. Manufacturing Engineering Technology

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Internship																
Required				X					X	X	X	X	X	X	X	X
Not Required			X													
Coop																
Required					X		X	X								
Not Required	X	X				X										
Credits																
Variable	X	X	X				X									
Fixed				X		X			X	X	X	X	X	X	X	X
Student Avail.																
Fall							X				X					
Winter							X									
Spring											X					
Summer									X	X	X	X		X		X
All Year	X	X	X	X	X	X		X					X		X	
Progress Record																
Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Not Required																
Graded	X	X	X	X		X	X	X	X		X		X	X	X	X
Not Graded										X		X				
Final Grade																
Pass/Fail	X		X	X	X	X	X	X				X	X	X		
Letter		X							X	X	X				X	X

Figure 1. REVIEW OF CURRICULUMS

SUMMARY OF LITERATURE REVIEW

Research specific to industrial internships is virtually non existent. Considerably more work has been accomplished relative to the cooperative education experience. While coops and internships are similar in nature, in that they both offer experiential elements as part of the learning experience, the cooperative experience is more lengthy and formal. This is not to say that many of the aspects of the cooperative system could not correlate with the industrial internship experience. Based on the previous statement, it can be concluded that:

1. The internship experience is a desirable experience form the standpoint of student development.
2. The student internship responsibilities must relate directly with the intern's field of study.
3. Internship programs must be carefully drafted to fit curriculum schedule constraints.
4. Internship programs may be limited to terms of length and scheduling flexibility if the degree program maintains a credit hour limit.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

This study is nonexperimental in design. While primarily descriptive in nature, a correlational component exists to aid in Statistically analyzing the data.

RESEARCH DESIGN

The research questions to be answered were:

1. What are the demographic characteristics of the respondents to the questionnaire?
2. What is the correlation between the respondents demographic characteristics and their responses to non-demographic questions on the questionnaire?
3. What correlation exists between respondents experience with internships and their responses to non-demographic survey questions?
4. What constitutes the proper length of time for an industrial internship?
5. Should the internship experience be offered throughout the calendar year?
6. To what extent should faculty be involved with the intern/internship site?
7. What constitutes proper work content for the student intern?
8. What should be the nature of compensation for a student intern?

9. Should student interns be compensated when required to locate at an internship site beyond commuting distance from home?

The independent variables in the correlational component of the study are:

1. Demographic characteristics of respondent's facility.
2. Prior experience of respondent with internships.

Dependent variables in correlational study:

1. Length of internship experience.
2. Desired availability of interns.
3. Faculty involvement.
4. Internship work content.
5. Internship compensation.
6. Willingness to hire an intern.

QUESTIONNAIRE FORMAT

The questionnaire was divided into four parts. The first part consisted of items 1 through 5 to determine the demographic characteristics of the respondents. The second part of the questionnaire contained items 6 through 15, which dealt with internship format and compensation. Items 16 and 17 (part three) concerned the respondents' willingness to hire an intern, and experience with internships other than offered by F.S.U. MFG. Item 18 (part four) was used to establish the status of the respondents' experience with the F.S.U. MFG internship (1 - currently involved, 2 - past internship site, 3 - no interns

experience). Item 18 was completed by the researcher. A code was put on the return envelope relative to the addressees' known MFG internship experience, prior to mailing. This ensured the anonymity of the respondent when item 18 responses were tabulated.

The questionnaire was reviewed by MFG faculty for clarity and content. The length of the questionnaire was limited to two pages, single-sided, and 18 items. The copies intended for distribution were reproduced at the F.S.U. Copy Center on light gray industrial department stationary. (Refer to the Appendices).

SELECTION OF SUBJECTS

The subjects used in this study were industrial firms in Michigan that were divided into three groups:

1. Past internship sites (F.S.U. MFG)
2. Current internship sites (Summer Quarter of 1989, F.S.U. MFG)
3. Industrial firms that did not have an internship experience (F.S.U. MFG)

FIELD PROCEDURES

A total of 200 questionnaires were mailed during September 1989. A self-addressed return envelope was included with each questionnaire to enhance the response rate. A cut-off date of May 30, 1990, was established for acceptance of returned

questionnaires. A brief letter was also included with the questionnaire explaining the nature of the survey (refer to Appendices).

DATA COLLECTION AND ANALYSIS

Prior to the deadline date, 78 of the 200 questionnaires (mailed out) were returned for a return rate of 39 percent. This is an acceptable return rate for this type of survey. No questionnaires were received after the deadline.

The data was collated and processed using the F.S.U. IBM mainframe computer. Statistical analysis of the data was accomplished using frequency distribution for percentage breakdown of replies, crosstabulation techniques for measures of association, and the Chi-Square test of independence for statistical significance. In situations where a given survey question may have several answer categories, and the response rate for a given category was determined insufficient for a credible statistical result, it was determined that categories would be pooled to obtain acceptable statistical results.

CHAPTER 4

RESEARCH FINDINGS

The data used for analysis was derived through responses to a mailed questionnaire. In some instances, data that is presented in the text will also be represented in chart form. The charts are utilized to enhance the perspective of those reviewing this document in regard to the relative magnitudes of specific sets of data. The values on pie charts provided are stated in percent, and the values on the columnar charts are presented as the number of survey responses. Results are calculated based on the 78 surveys. The results are reported individually for each research question and include statistical methods used and findings, a test of statistical significance (Chi-Square) when appropriate, and a statement of support for the question.

Research Question 1. What are the demographic characteristics of the respondents to the questionnaire? (Ref. survey questions 1, 2, 3, 4, 5)

Table 1

Characteristics of Responding Facility

Facility Type	Number	Percent
Division	39	50
Sole Entity	39	50
TOTAL	78	100

Table 2

Respondent Represents

Physical Plant	Number	Percent
One Facility	44	56
Multi-plant	34	44
TOTAL	48	100

Table 3

Size of Facility in $(Millions)

Firm Assets	Number	Percent
Less than 10	16	22.5
10 - 24.9	13	18.3
25 - 49.9	8	11.3
50 - 99.9	13	18.3
Greater than 100	21	29.6
TOTAL	71	100

Table 4

Size of Facility Based on Number of Employees

No. of Employees	Number	Percent
Less than 20	1	1.3
20 - 99	9	11.5
100 - 149	15	19.2
150 - 499	22	28.2
More then 500	31	39.8
TOTAL	78	100

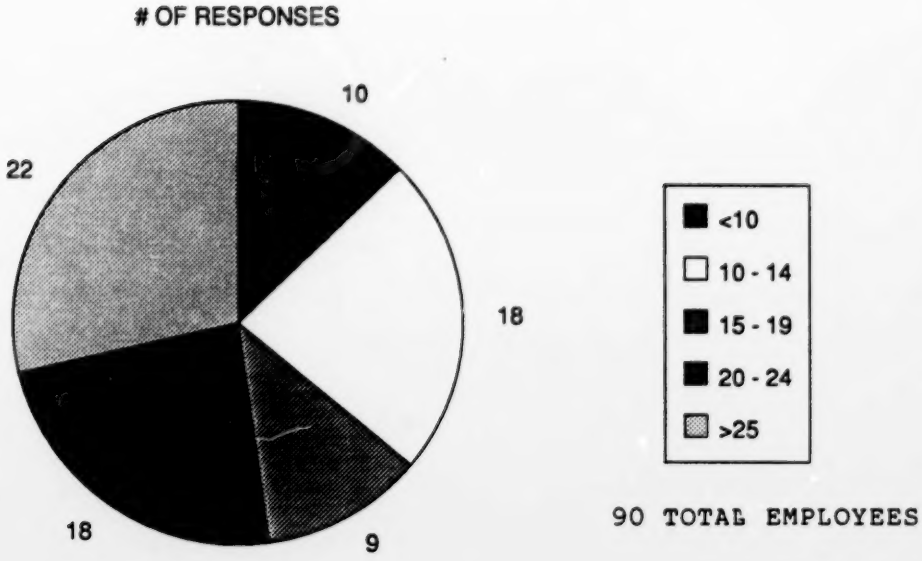

Figure 2. PERCENTAGE OF TOTAL EMPLOYEES THAT ARE SALARIED

Research Question 2. What is the correlation between the respondents demographic characteristics and their responses to non-demographic questions on the questionnaire?

The sets of data selected relate to the size of the facility (items 3 and 4 on the questionnaire) and are correlated with questions that relate to the nature of intern work and cost of living subsidies (questions 13 and 15 respectively).

3. What is the size of your facility in terms of assets (millions of dollars)?

13. The internship experience should start with "production" type work and progress to more sophisticated "engineering" functions in the later stages of the internship.

Table 5

Survey Question 3 By Question 13

	Responses in Percent			
Assets $(Million)	Disagree	Neutral	Agree	Total
Less than 25	6.9	24.1	69.0	100
25 - 99.9	28.6	28.6	42.9	100
Greater than 100	28.6	9.5	61.9	100

Chi-Square 7.54247 PL .1099
The analysis does not support the question

3. What is the size of your facility in terms of assets (millions of dollars)?

15. I would be willing to offer a cost of living subsidy to student interns required to locate away from home.

Table 6

Survey Question 3 by Question 15

Assets $(Million)	Responses in Percent Disagree	Neutral	Agree	Total
Less than 25	48.1	33.3	18.5	100
25 - 99.9	61.9	28.6	9.5	100
Greater than 100	60.0	15.0	25.0	100

Chi-Square 3.40513 PL .4924
The analysis does not support the question

4. How many employees work at your firm/facility?

13. The internship experience should start with "production" type work and progress to more sophisticated "engineering" functions in the later stages of the internship.

Table 7

Survey Question 4 by Question 13

No. of Employees	Percent Disagree	Neutral	Agree	Total
Less than 150	12.0	24.0	64	100
150 - 499	22.7	18.2	59.1	100
Greater than 500	29.0	16.1	54.8	100

Chi-Square 2.51467 PL .6420
The analysis does not support the question

4. How many employees work at your firm/facility?

15. I would be willing to offer a cost of living subsidy to student interns required to locate away from home.

Table 8

Survey Question 4 by Question 15

No. of Employees	Percent Disagree	Neutral	Agree	Total
Less than 150	43.5	39.1	17.4	100
150 - 499	54.5	36.4	9.1	100
Greater than 500	66.7	13.3	20.0	100

Chi-Square 6.11801 PL .1905
The analysis does not support the question

Research Question 3. What correlation exists between respondents experience with internships and their responses to non-demographic survey questions?

The results of this analysis will be presented in conjunction with response data concerning research questions 4 through 9, and will be evaluated using the Chi-Square test and associated "P" level of significance (Ref. Pages 29 - 46). The following data describes respondent experience with the F.S.U. Manufacturing Engineering internship program.

Table 9

Ref. Survey Question 18 "Internship Experience"

Experience	No.
Current Site	9
Past Site	10
Never	49
TOTAL	68

Summary

Have Experience - 29
No Experience - 49

Ref. Fig. 3

Table 10

Ref. Survey Question 17 "Engaged in internship with school other than F.S.U."

	Internship Site No.
Yes -	34
No -	43
TOTAL	77

Ref. Fig. 4

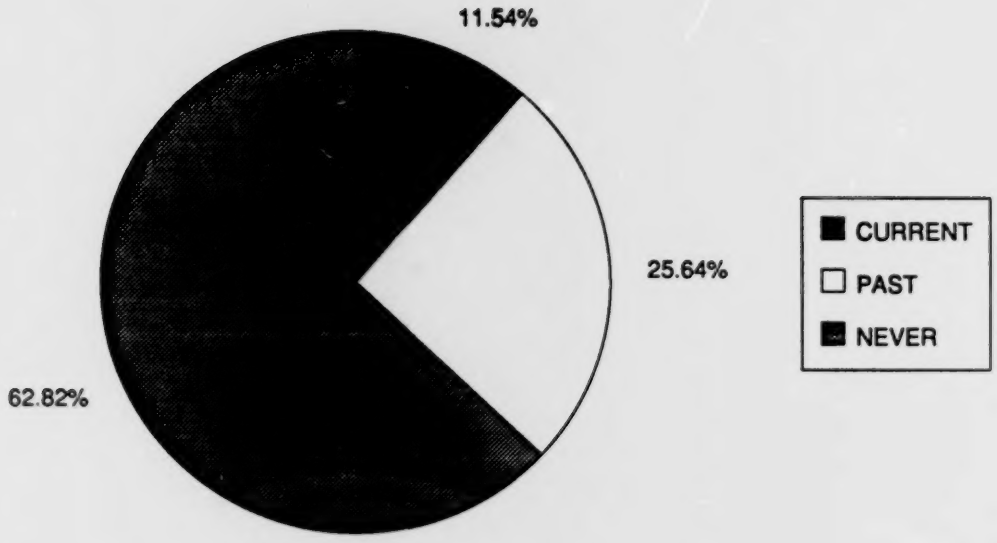

Figure 3. EXPERIENCE WITH P.S.U. MFG. ENG. TECH. PROGRAM INTERNSHIP

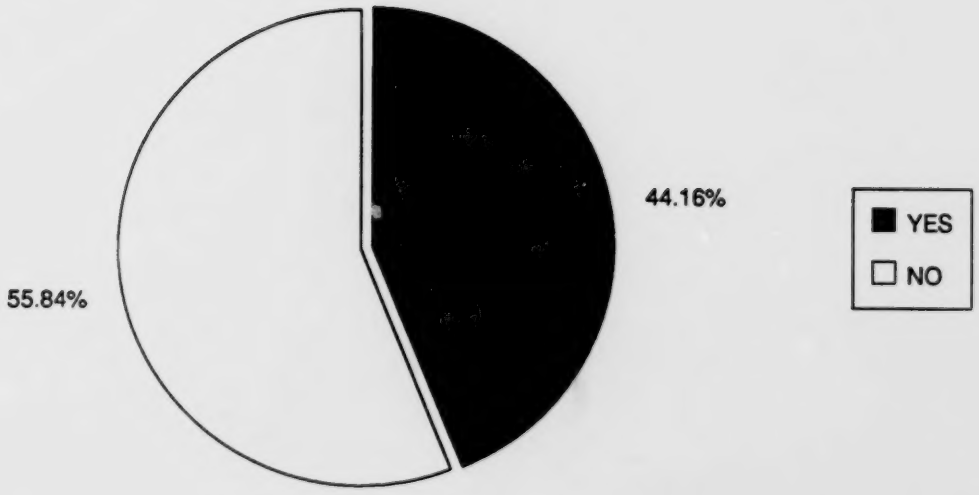

Figure 4. CURRENTLY ENGAGED IN INTERNSHIP RELATIONSHIP WITH OTHER SCHOOLS

Research Question 4. What constitutes the proper length of time for an industrial internship? (Ref. Survey Questions 6 and 7)

Table 11

I favor the current (10 week) internship requirement offered during the Summer Quarter.

Response	No.	Percent
Disagree	17	22.7
Neutral	20	26.7
Agree	38	50.7
TOTAL	75	100

Chi-Square 4.54458 PL .1031
The analysis does not support research question 3

Ref. Fig. 5

Table 12

I prefer concept of a dual (20 week) internship.

Response	No.	Percent
Disagree	11	14.7
Neutral	29	38.7
Agree	35	46.7
TOTAL	75	100

Chi-Square 1.2220 PL .5428
The analysis does not support research question 3

Ref. Fig. 6

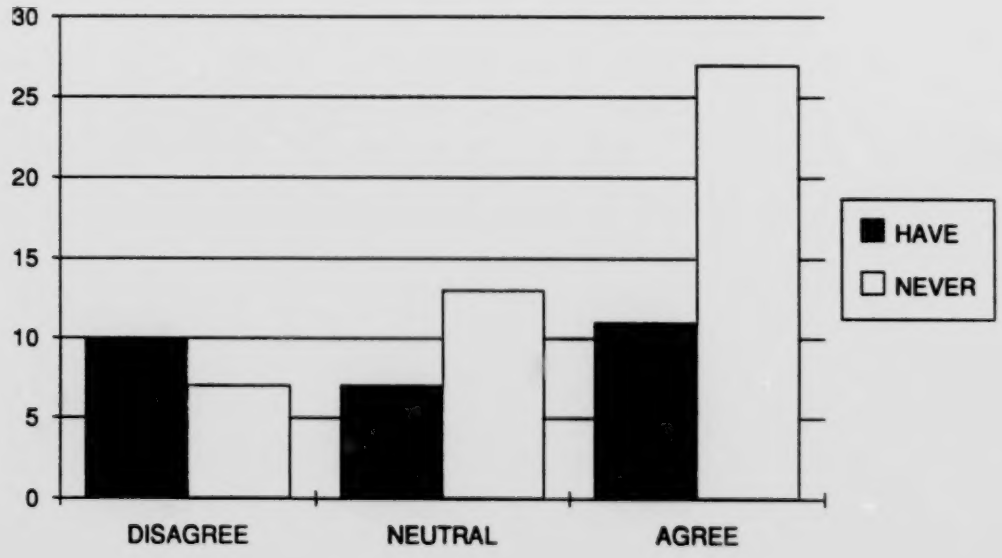

Figure 5. FAVOR 10 WEEK INTERNSHIP

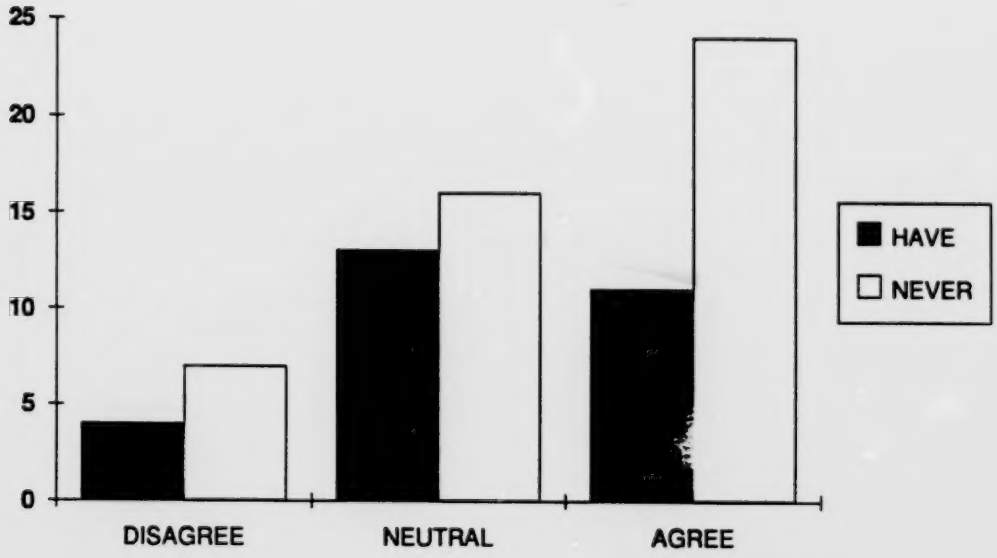

Figure 6. PREFER DUAL (20 WEEK)

Research Question 5. Should the internship experience be offered throughout the calendar year? (Ref. Survey Questions 8 and 16)

Table 13

An internship format that allows students to be available at an intern site throughout the year is preferable.

Response	No.	Percent
Disagree	8	10.4
Neutral	20	26.0
Agree	49	63.6
TOTAL	77	100

Chi-Square 2.45536 PL .2930
The analysis does not support question 3

Ref. Fig. 7

Table 14

I would be more willing to hire a Manufacturing Engineering Technology intern if:

Intern Availability	No.	Percent
Summer	13	17.6
All Year	61	82.4
TOTAL	74	100

Chi-Square .99178 PL .3193
The analysis does not support research question 3

Ref. Fig. 8

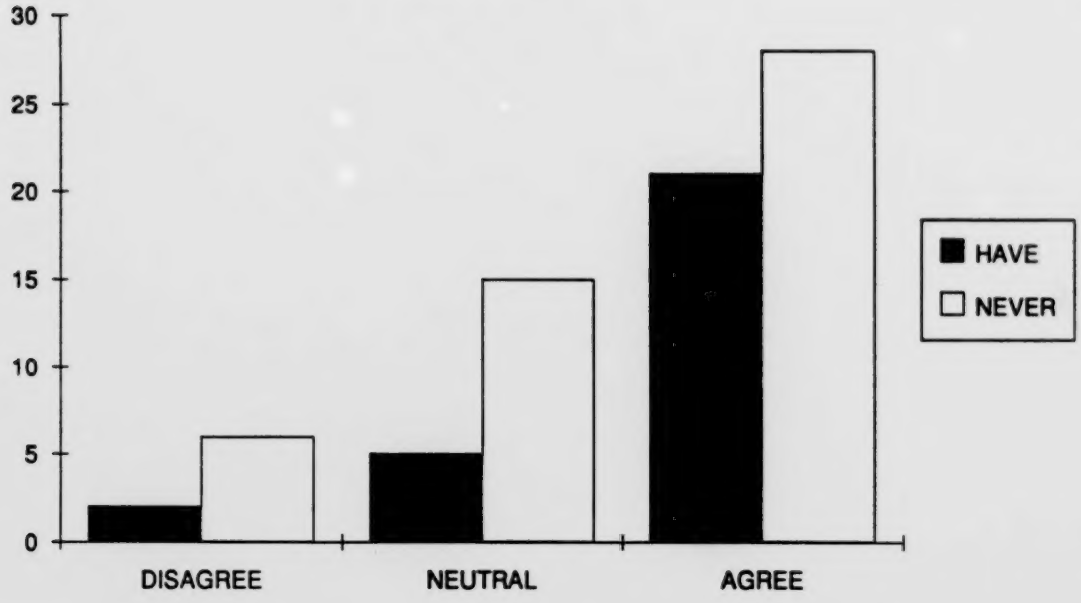

Figure 7. PREFER CALENDAR YEAR AVAILABILITY

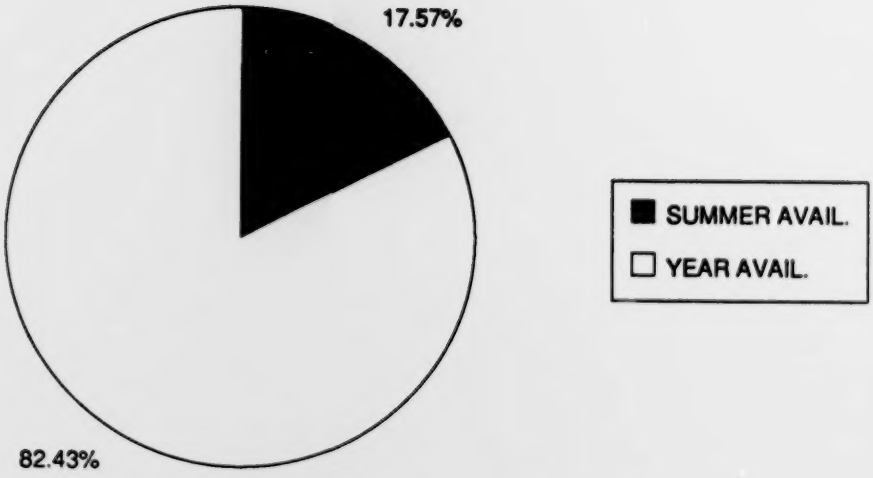

Figure 8. I WOULD BE WILLING TO HIRE A MFG. ENG. TECH. INTERN IF:

Research Question 6. To what extent should faculty be involved with the internship site? (Ref. survey questions 9, 10, and 11)

Table 15

Faculty should be involved only with student internship placement.

Response	No.	Percent
Disagree	22	28.9
Neutral	8	10.5
Agree	46	60.5
TOTAL	76	100

Chi-Square 2.47334 PL .2903
The analysis does not support research question 3

Ref. Fig. 9

Table 16

Faculty should assist student intern with projects.

Response	No.	Percent
Disagree	26	34.2
Neutral	19	25.0
Agree	31	40.8
TOTAL	76	100

Chi-Square 4.94813 PL .0842
The analysis does not support research question 3.

Ref. Fig. 10

Table 17

Faculty should monitor and evaluate the students activities and performance.

Response	No.	Percent
Disagree	8	10.4
Neutral	12	15.6
Agree	57	74
TOTAL	76	100

Chi-Square .73058 PL .6940
The data does not support a correlation between internship experience and responses indicated.

Ref. Fig. 11

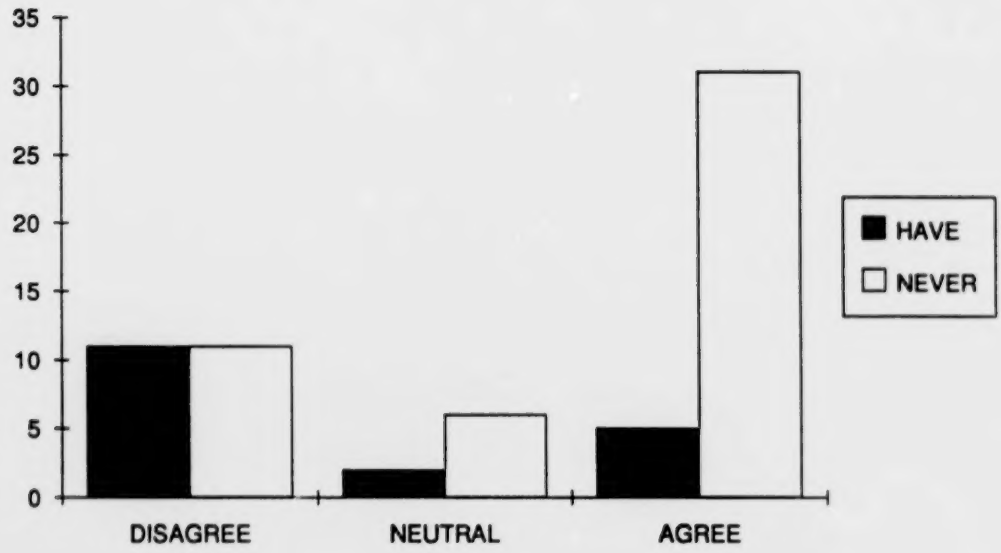

Figure 9. COORDINATE STUDENT PLACEMENT

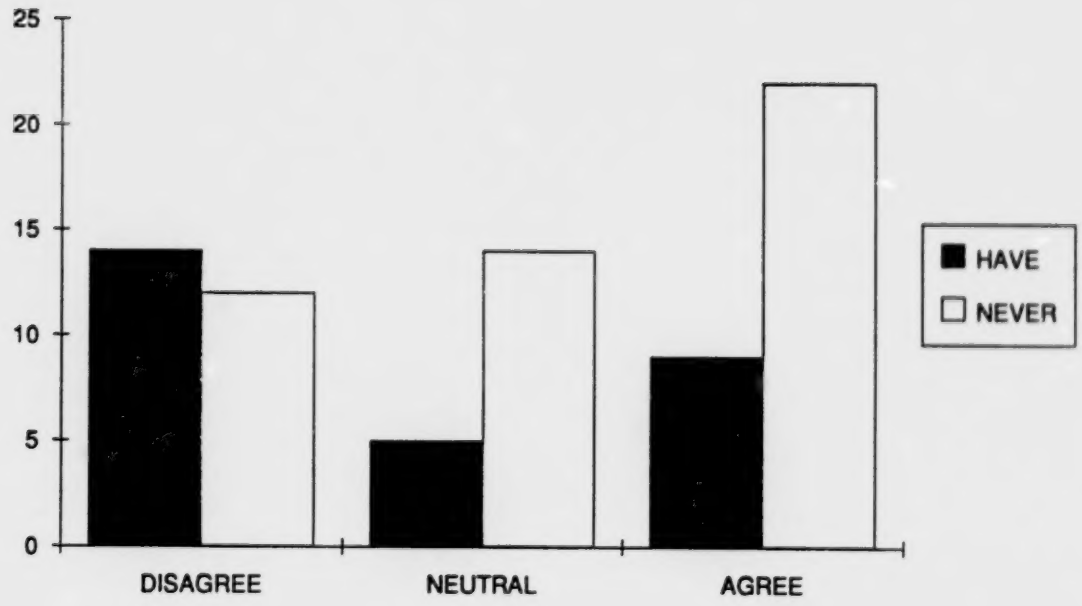

Figure 10. FACULTY ASSIST WITH INTERN PROJECTS

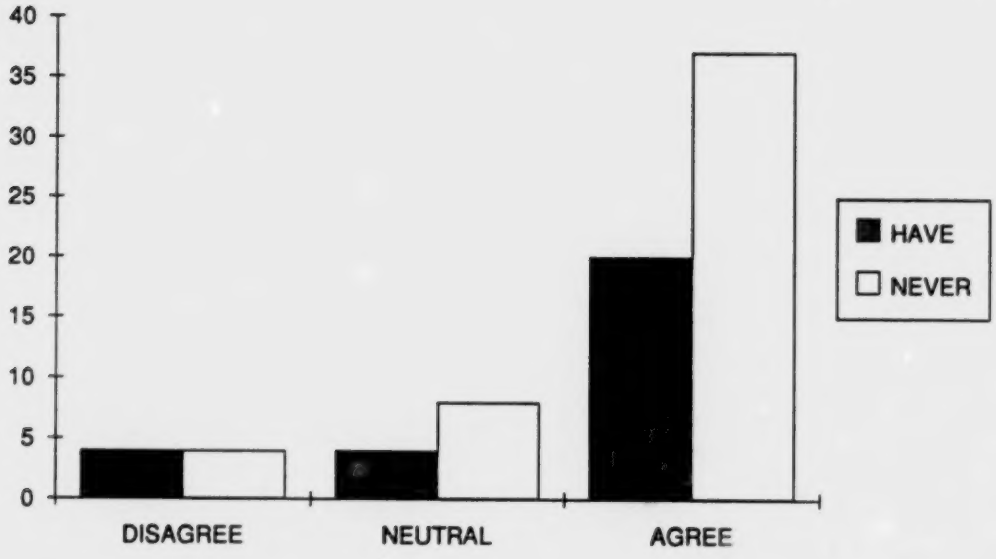

Figure 11. MONITOR AND EVALUATE STUDENTS

Research Question 7. What constitutes proper work content for the student intern? (Ref. survey questions 12 and 13)

Table 18

The student intern should be assigned manufacturing engineering related responsibilities (project work).

Response	No.	Percent
Disagree	9	11.7
Agree	68	88.3
TOTAL	78	100

Chi-Square .00000 PL 1.0000
Analysis does not support research question 3.

Ref. Fig. 12

Table 19

The internship experience3 should start with 'production' type work and progress to more sophisticated 'engineering' functions in the later stages of the internship.

Response	No.	Percent
Disagree	17	22.1
Neutral	15	19.5
Agree	45	58.4
TOTAL	77	100

Chi-Square 1.46256 PL .4813
The analysis does not support research question 3.

Ref. Fig. 13

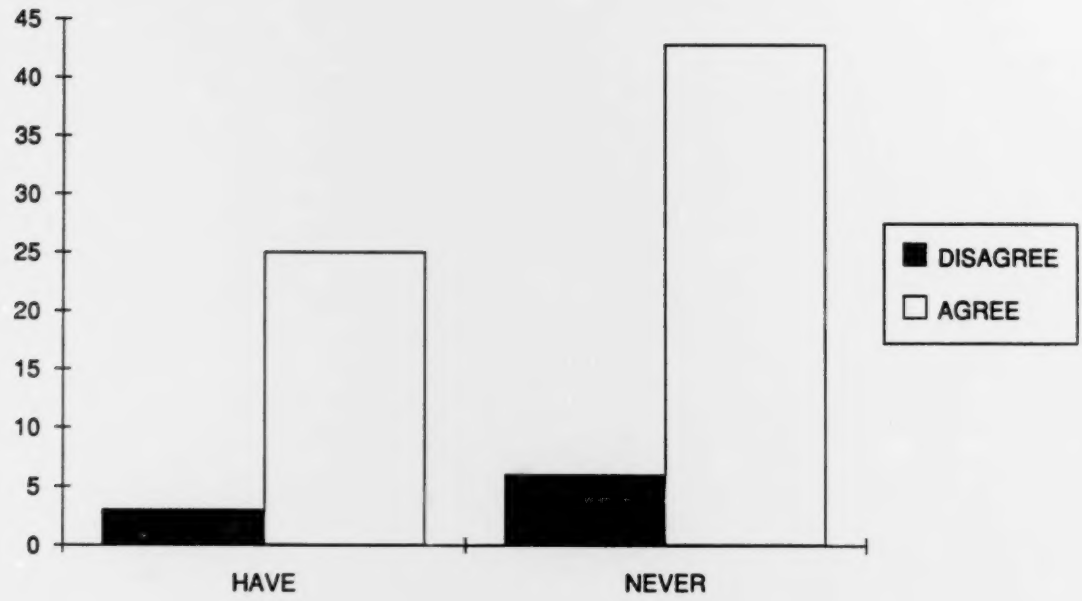

Figure 12. ASSIGN MFG. ENG. WORK

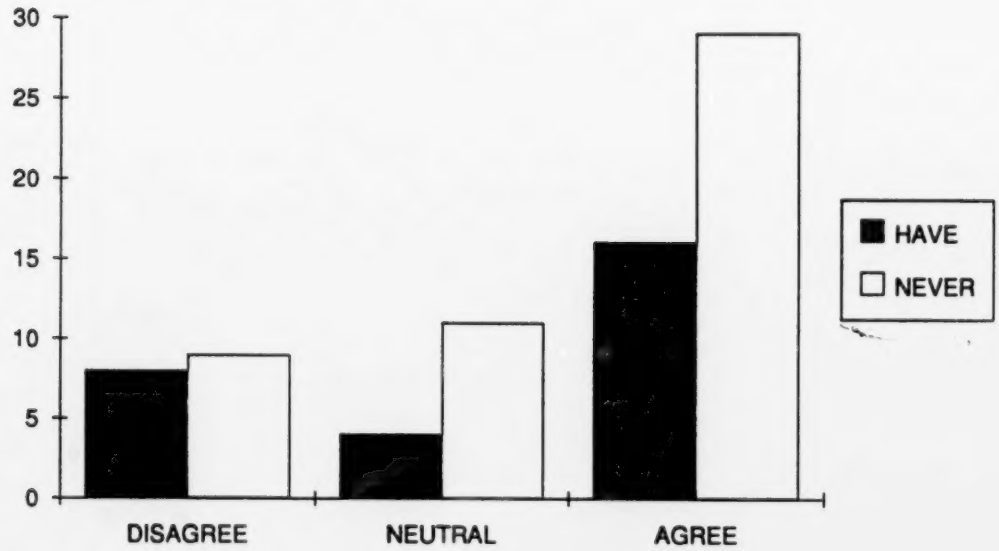

Figure 13. PRODUCTION WORK PROGRESSING TO ENGINEERING FUNCTIONS

Research Question 8. What should be the nature of compensation for a student intern? (Ref. survey question 14)

Table 20

The internship experience should be a paid experience with salary negotiated between the student and the intern site.

Response	No.	Percent
Disagree	13	16.9
Agree	64	83.1
TOTAL	77	100

Chi-Square .02066 PL .8857
The analysis does not support research question 3.

Ref. Fig. 14

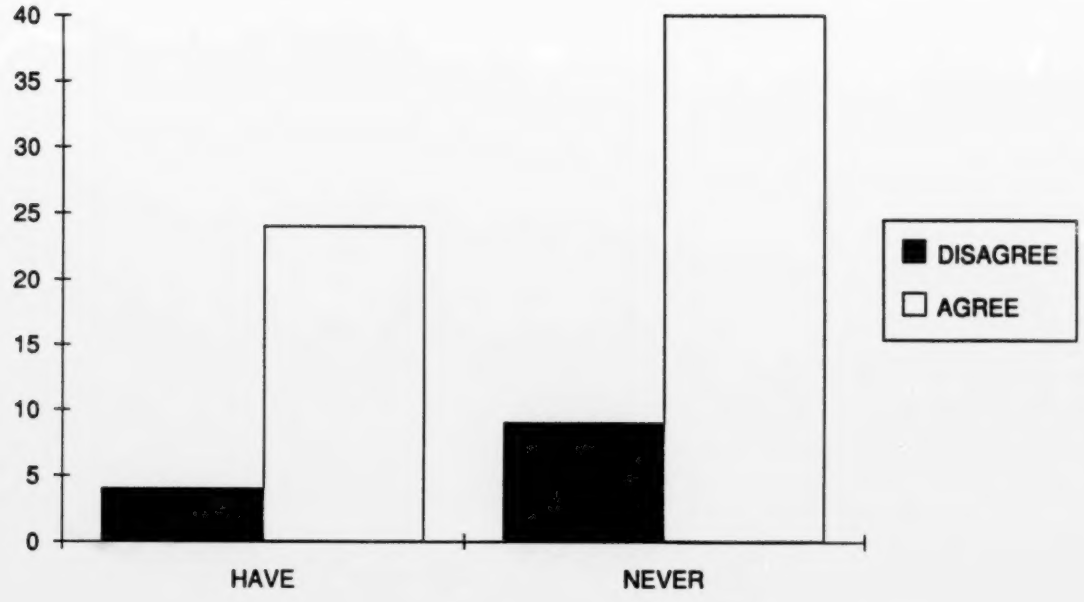

Figure 14. SALARY NEGOTIATED BETWEEN STUDENT AND INTERN SITE

Research Question 9. Should student interns be compensated when required to locate at an internship site beyond commuting distance from home? (Ref. survey question 15)

Table 21

I would be willing to offer a cost of living subsidy to interns required to locate away from home.

Response	No.	Percent
Disagree	42	56.8
Neutral	21	28.4
Agree	11	14.9
TOTAL	74	100

Chi-Square 3.04124 PL .2175
The analysis does not support research question 3.

Ref. Fig. 15

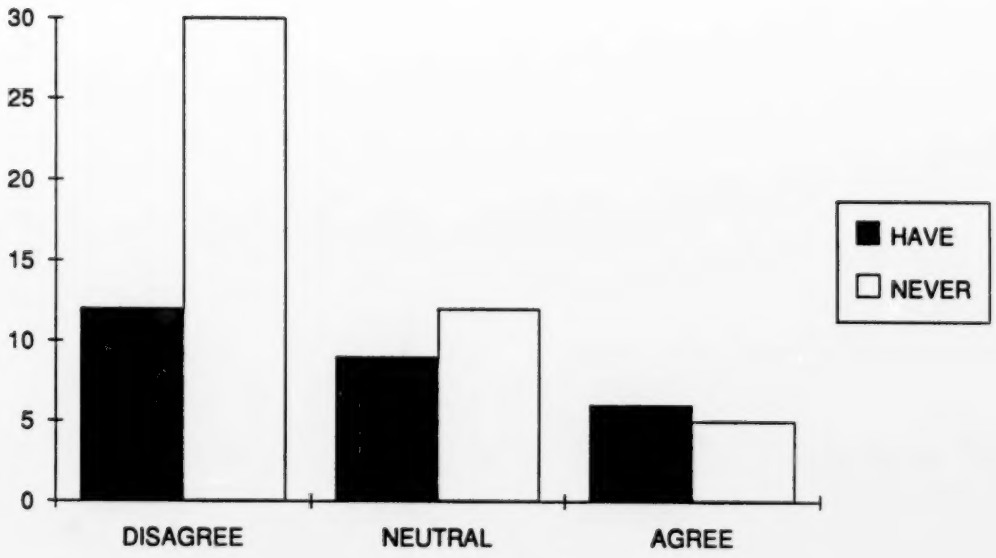

Figure 15. OFFER COST OF LIVING SUBSIDY

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The Manufacturing Engineering Technology program at Ferris State University is involved in a program of continuous improvement. This is in recognition of the fact that the market (industry) that it serves is in a dynamic state. The technology that industry utilizes to accomplish its mission is continuously changing, and this change is also impacting the operational characteristics of industry. As part of the effort to maintain currency with the needs of industry, the Manufacturing Engineering Technology program faculty at F.S.U. maintain a close liaison with representatives of industry with the intendant purpose of receiving guidance in terms of what needs to be incorporated in program content to properly prepare F.S.U. Manufacturing Engineering Technology graduates to fulfill their roles in industry once they graduate.

A major component of the Manufacturing Engineering Technology program is the industrial internship. This component is a practical work experience that permits the student to apply classroom theory in a real-world industrial setting, and better prepare the student for transition into a productive role in industry upon graduation.

A purpose of this study was to determine if the structure and administration of the manufacturing internship is congruent with commonly accepted practice (literature review) in similar programs throughout academia. The major thrust of this study was

to determine if the current internship design is satisfactory in terms of the perspective of industry, and to provide insights into program changes that may improve the internship experience.

The study reports the results of a survey mailed to 200 industrial manufacturing engineering professionals throughout the state of Michigan. The instrument consisted of 18 items, encompassing the demographic characteristics of the respondents, the format of the internship, and the respondent experience with internship programs.

SUMMARY

The findings of this study are summarized by the statement of the results of the individual research questions.

1. 50% of responding facilities are a division of a larger corporation, while 50% are characterized as a sole entity.
2. 56% of the respondents represent a single facility and 44 percent represent multiple facilities.
3. The majority of facilities fall into two groups, one having assets less than $10 million dollars (22.5%), the other having assets of more than 100 million dollars (29.6%).
4. 39.8% of responding facilities have more then 500 employees.
5. 28.95 percent of responding facilities have a salaried workforce that is greater than 25% of the total work force.
6. The demographic characteristics (questions 3 and 4) of the respondents are not a significant factor in affecting their responses to non-demographic questions (questions 13 and 15).

7. Respondent experience with internships is not a significant factor in determining their responses to non-demographic questions.
8. 50.7% of the respondents favored the current (10 week) internship schedule during the Summer quarter.
9. 46% of the respondents favored the concept of a dual (20 week) internship.
10. 63.6% of respondents preferred an internship format that permitted intern availability throughout the calendar year.
11. 82.4% of the respondents indicated a greater willingness to hire student interns if they were available throughout the year.
12. 60.5% of the respondents felt that the role of the faculty intern coordinator should be confined to intern placement.
13. 40.8% agreed and 34.2% of the respondents disagreed as to whether the faculty coordinator should take an active role in assisting the intern with internship site projects.
14. 88.3% of the respondents indicated that the intern should be given manufacturing engineering related work assignments.
15. 58.4% of the respondents indicated that it was acceptable to assign interns production type work during the initial phases of the intern experience and schedule them into engineering functions as the experience progressed.
16. 83.1% of the respondents indicated that it should be up to the intern and intern site to negotiate intern compensation.

17. 56.8 percent of the respondents were not willing to provide a cost of living subsidy for interns required to locate away from their home.

CONCLUSIONS

A comparison of the Manufacturing Engineering Technology internship with the internships of other programs/schools indicates that the F.S.U. Manufacturing Engineering Technology internship criteria falls into a matrix of commonly accepted practice. With regard to the relationship with industry, the results of the survey support what is current practice with the Manufacturing Engineering Technology internship, with few exceptions.

1. The study results confirm that the current 10 week internship is acceptable to the industry participants.
2. The study results confirm that, should the Manufacturing Engineering Technology faculty elect to revise the program to embrace a 20 week dual internship, it would be acceptable.
3. The results confirm that the faculty internship coordinator play only a limited role in the on-site activities of the intern. Current practice casts the coordinator in the role of a facilitator insuring that the intern and the intern site fulfill an agreed upon set of obligations as defined in the program internship guide.

4. The results of the study confirm that the intern site should provide an on-site experience that exposes the student to real-world manufacturing engineering responsibilities.
5. The results of the study confirm that, as is program practice, the compensation for the intern be negotiated between the intern and intern site, with the faculty coordinator acting only as an advisor to the student intern.
6. The results of the study confirm the practice of locating interns at intern sites within a reasonable commuting distance, as much as is possible, to reduce the financial hardship of relocation, as intern sites indicate a reluctance to compensate interns for relocation.
7. The results of the study indicate that potential intern sites would be highly receptive to having interns available throughout the year. This is not permitted under the current Manufacturing Engineering Technology program design.

RECOMMENDATIONS

The Manufacturing Engineering Technology faculty should examine the current program offerings and course sequence to determine the feasibility of making available interns to industrial sites beyond Summer Quarter. The existing program course sequence (Ref. Program Check Sheet, Appendices) permits program entry only during the Fall Quarter. The student must follow a rigidly established course sequence. Incorporating entry points into the program at other quarters would provide the

student sufficient flexibility to take the internship experience at other points during the year.

Additional research should be conducted to determine if the manufacturing program is targeting a representative cross section of Michigan industry when soliciting internship sites. This can be done by comparing the demographic characteristics of survey respondents who have experienced the F.S.U. internship with the published demographic characteristics of Michigan industry. The results would appraise the program faculty as to whether or not they were limiting their possibilities in obtaining internship sites for their students.

WORKS CITED

Cosgrove, Stanley L., Cooperative Education - Its Impact on Academe, College of Engineering, University of Cincinnati, Cincinnati, Ohio, 1979

Dallas, D.B., Manufacturing Engineering Defined (special technical report to the membership of SME). Dearborn, MI: Society of Manufacturing Engineers, June 1978

Law, Gordon F. (editor) Contemporary Concepts in Vocational Education. The first yearbook of the American Vocational Association. Washington, D.C., 1971

Madonna, L. A., "Engineering Internship A System of Integrated Education", Journal of Cooperative Education, Vol. XI-2 May, 1975

Pierce, Joseph H. and Birmingham, Roy J., The Cooperative Internship Program: Giving Students the Best of Both Worlds, Engineering Education, January 1981

Weinstein, Dena A., Cooperative Education Program Strategies and Student Career Development in Business and Engineering Curricula, Journal of Cooperative Education, Northeastern University, Boston, MA

Winer, Ellen N.; Howe, George K.; and Berestecky, Boreslaw P., Job Satisfaction and Cooperative Engineering Students, Journal of Cooperative Education Volume X-2 (May, 1974) pp. 35 - 39

Yensco, William R., Comparing Engineering Graduates From Cooperative and Regular Programs, Engineering Education, American Society for Engineering (1971) p. 818

REFERENCES CONSULTED

Bulletin, Brigham Young University, Provo, Utah

Catalog, Grand Valley State University, Allen dale, MI 49401, 1989

Cooperative Education Association, Constitution and By-Laws, Cooperative Education Research Center, Northeastern University, Boston MA 02115

Cooperative Engineering Education, College of Engineering, Michigan State University, East Lansing, MI 48825-1208

Cosgrove, Stanley L., Cooperative Education - Its Impact on Academe, College of Engineering, University of Cincinnati, Cincinnati, Ohio, 1979

Curtis, Mark Allen, The Development of the Curriculum Model for undergraduate Education of Manufacturing Engineers, Western Michigan University, 1982

Defore, J., Characteristics of Engineering Tech. Student"

Edwards, John T., An Analysis of Manufacturing Engineering Technology Programs Throughout Indiana, Kentucky, and Ohio. Presentations at American Vocational Association Convention, New Orleans, LA Dec., 1984

Ellis, R., Coop Engineering Education, A Structured Approach the LIT Story"

Engineering Cooperative Education, University of Michigan - Dearborn, 4901 Evergreen Road, Dearborn, MI 48128

Engineering Cooperative Education, Western Michigan University, Kalamazoo, MI 49008-5041

Epting, L., A Comparative Analysis of the Job Satisfaction of 1973-1978 MS State Univ. Engineering Grads from Coop and Non-coop Programs"

Freund, C., "Coop Students in the Classroom", University of Detroit

Glover, Robert W., Alternance Training in Texas: A Preliminary Overview, Center for the Study of Human Resources, Texas University, Austin, 1987

Greenwald, S., "The Co-op Engineer-partnership between Industry and Education", Electronics World, One Park Avenue, NY 16, August, 1968

Guideline and Procedures for the Industrial and Leadership Internship Experience, Department of Industrial and Engineering Technology, Central Michigan University, Mt. Pleasant, MI 48859

Hunt, Donald C., 50 Views of Cooperative Education, 5 ed., University of Detroit, 1987

Lawrence Institute of Technology Catalog, Lawrence Institute of Technology, 21000 West Ten Mile Road, Southfield, MI 48075-1058

Ovans, Gary L., Survey of School of Technology Internships,

Society of Manufacturing Engineers, Directory of Manufacturing Education Programs in Colleges, Universities, and Technical Institutes, Society of Manufacturing Engineers, Dearborn, MI, 1988

Wohlford, James G., "Accreditation/Certification of Engineering and Engineering Tech. Programs", Journal of Cooperative Education, Vol. IX-1, November, 1972

APPENDICES

APPENDIX A

CURRICULUM REQUIREMENTS

CURRICULUM REQUIREMENTS
MANUFACTURING ENGINEERING TECHNOLOGY

ENTRY CRITERIA

1. Associate Degree in a Manufacturing-based Technology (or 90 credit hours of college course work including technical courses, general courses, and technical related courses).
2. Application submitted by February 15 prior to Fall term requested.
3. 2.75 H.P.A. in major courses.
4. 2.50 H.P.A. in mathematics, through MTH 124 (or equivalent) or completion of MTH 231.

TECHNICAL	CREDIT HOURS
CAM 353 CAD/CAM	3
EET 491 Electronics	3
EET 496 Electrical Con.	5
MET 225 Stat. & Str.	4
MFG 313 Prod. Processes	4
MFG 316 Metrology	3
MFG 331 Motion & Time	4
MFG 333 Cost Estimating	2
MFG 330 Computer App.	3
MFG 351 Tool Engineering	5
MFG 362 MFG Facilities	4
MFG 371 Mach. Shop	4
MFG 390 Prof. Internship	6
MFG 421 Process Planning	4
MFG 422 Adv. Proc. Plan.	3
MFG 425 Eng. Econ.	3
MFG 452 Auto. & Sys. Des.	4
MFG 454 Production Control	3
MFG 461 Stat. Quality Con.	4
MFG 465 Quality Eng.	4
PLT 421 Plastics Proc.	3
WEL 413 Prod. Welding Proc.	3

GENERAL EDUCATION	CREDIT HOURS
Humanities	6
HUM 217 Intro. to Logic	3
ECN 221 Prin. of Econ. I	4
ECN 222 Prin. of Econ. 2	4
MTH 125 Adv. Alg/Trig	5
MTH 231 Geo. & Calc I	5
PHY 241 Physics I	5
SPC 432 Tech. Present.	3

The following course may also be required if competency in this area cannot be demonstrated:

MTL 221 Basic Metal. 4

B.S. Degree Minimum General Education Requirements (including Associate degree courses):

Humanities Credits - 12
English Credits - 9
Behavioral Science Credits - 12
Natural Science Credits - 12

Student is responsible to meet prerequisite requirements for all classes.

APPENDIX B

SURVEY LETTER

Ferris State University
Manufacturing Division

August 29, 1989

The Manufacturing Engineering Technology faculty in the School of Technology at Ferris State University are currently developing major revisions to the Manufacturing Engineering Technology program. The desired end result will be a program upgrade that will produce student graduates with the types of skills that will meet the needs of industry for the foreseeable future.

A major component of our proposal for program change will be the revision of our student internship requirement. Currently, students must complete a ten week internship encompassing Manufacturing Engineering related activities. Normally, this is accomplished during the Summer quarter between their junior and senior year. The proposed format would entail the completion of two, ten week internships. According to course sequence, they may be taken back-to-back or alternated between on-campus periods of instruction. The format envisioned would permit participating sites to have interns on-site throughout the calendar year. To justify a move to this kind of internship format requires your input. As potential employers of our students, it is important that we consider your needs. In doing so, we need to know how you think we can best prepare our students to successfully perform in industry. We are a hands-on applications-oriented program; therefore, we tend to be biased in our thinking about the worth and nature of internships. What do you think?

To enable you to help us consider your insights into internship experiences, I have enclosed a questionnaire and a pre-addressed postage paid envelope. Your cooperation is requested in filling out the survey. Responses will remain anonymous and all information will be handled in a confidential manner. It is vital that we have your input. Please return the document as soon as possible. If you desire a copy of the results of this study, please feel free to contact me. My business card is enclosed.

Thank you for your cooperation.

Sincerely,

Gary Ovans
Assistant Professor
Manufacturing Engineering Technology

Enclosure

a:MFG-SURV.LET

BEST COPY AVAILABLE

College of Technology • 901 S. State Street • Big Rapids, Michigan 49307-2295 • (616) 592-5979

APPENDIX C

SURVEY QUESTIONNAIRE

INTERN SITE QUESTIONNAIRE

Results from this questionnaire will aid in determining the most desirable model (industry perspective) for the Manufacturing Engineering Technology Internship. Please write additional comments on the back and refer to a specific item if appropriate.

1) Your firm is best characterized as:
   [ ] A division of a larger organization
   [ ] A sole entity

2) Are you representing one facility or the entire firm (multiplant or division) in your responses to this survey?
   [ ] one facility
   [ ] multiplant

3) What is the size of your facility in terms of assets (millions of dollars)?
   [ ] Less than 10
   [ ] 10 - 24.9
   [ ] 25 - 49.9
   [ ] 50 - 99.9
   [ ] Greater than 100

4) How many employees work at your firm/facility?
   [ ] Less than 20
   [ ] 20 - 99
   [ ] 100 - 249
   [ ] 250 - 499
   [ ] Greater than 500

5) Of the total number of employees in your firm/facility, what percentage are salaried?
   [ ] Less than 10
   [ ] 10 - 14
   [ ] 15 - 19
   [ ] 20 - 24
   [ ] More than 25

Internship Format: For the following items, please indicate your level of agreement or disagreement.

[5] = Strongly agree
[4] = Agree
[3] = Neutral or don't know
[2] = Disagree
[1] = Strongly disagree

6) I favor the current (10 week) internship requirement offered during the summer quarter.

[5] [4] [3] [2] [1]

7) I prefer the concept of a dual (20 week) internship.

[5] [4] [3] [2] [1]

8) An internship format that allows students to be available at the intern site throughout the calendar year is preferable.

[5] [4] [3] [2] [1]

9) **Faculty should be involved with the student/internship site only to the extent necessary for coordination of student placement.**

[5] [4] [3] [2] [1]

10) **Faculty should be involved with the student/internship site to the extent that they provide technical assistance related to intern projects.**

[5] [4] [3] [2] [1]

11) **Faculty should be involved with the student/internship site to the extent necessary to monitor and evaluate the students activities and performance.**

[5] [4] [3] [2] [1]

12) **The student intern should be assigned Manufacturing Engineering related responsibilities (project work).**

[5] [4] [3] [2] [1]

13) **The internship experience should start with 'production' type work and progress to more sophisticated 'engineering' functions in the later stages of the internship.**

[5] [4] [3] [2] [1]

14) **The internship experience should be a paid experience with the salary negotiated between the student and intern site.**

[5] [4] [3] [2] [1]

15) **I would be willing to offer a cost of living subsidy to student interns required to locate away from home.**

[5] [4] [3] [2] [1]

Check the most correct response:

16) **I would be more willing to hire a Manufacturing Engineering Technology intern if:**

[ ] **Interns were available only during the summer.**
[ ] **Interns were available throughout the calendar year.**

17) **Are you currently engaged in an internship or co-op arrangement with a school(s) other than Ferris State University?**

[ ] Yes
[ ] No

18) [1] [2] [3]

Thank you for your response.

A:INT-SITE.QUE

BEST COPY AVAILABLE

APPENDIX D

SCHOOL OF TECHNOLOGY QUESTIONNAIRE

July, 1990

Dear Colleagues,

Would you be so kind to respond to a few brief questions that deal with you program requirements? (Baccalaureate only)

1) Does your program require that an internship experience be completed by the students? Yes _____ No _____

If the answer to #1 is yes, please answer the following?

2) Are credits awarded fixed _____ or variable _____, and if so how many are awarded (fixed _____), (Variable limit _____)?

3) When is your internship offered? Summer _____
Fall _____
Winter _____
Spring _____
All Year _____

4) What is the duration of your internship requirements?
Weeks _____
Quarters _____

5) Are progress reports required from your students?
Frequency _____
(weekly, monthly)
Graded _____ Ungraded _____

6) Upon completion will the student receive a pass/fail or letter grade?

Thank you in advance for your cooperation. Would you please forward the completed form to my attention, Swan 107, Gary Ovans.